

INFANT DEVELOPMENT AND PARENTS' PERCEPTIONS ASSOCIATED WITH USE OF THE HARRIS INFANT NEUROMOTOR TEST*

DESENVOLVIMENTO INFANTIL E A PERCEPÇÃO DOS PAIS ASSOCIADO AO USO DO HARRIS INFANT NEUROMOTOR TEST

DESARROLLO INFANTIL Y LA PERCEPCIÓN DE LOS PADRES ASSOCIADO AL USO DEL HARRIS INFANT NEUROMOTOR TEST

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This work aimed to identify the socio-economic, health, and educational profiles of parents, as well as their perceptions of their infants' motor development in the first year of life. This descriptive study was carried out from November/2008 to February/2009. Participants in the study were 50 infants and 50 parents/guardians, in Fortaleza-Brazil. We used the Portuguese version of the Harris Infant Neuromotor Test (HINT) with infants ranging in age from 3 months to 11 months and 20 days. Twenty-six infants (52%) were boys. The mean age of the mothers was 24.5 years. Of the caregivers, 23 (46%) lived in stable marital relationships, sixteen (32%) had finished secondary education, and 27 (54%) of the families had incomes between R\$ 464,72 (US\$202.05) and R\$ 929,44 (US\$404.10). Participating caregivers were generally accurate in their own perceptions of their children's development when compared to the numeric HINT scores assessed by nurses trained in infant development.

DESCRIPTORS: Child Development; Caregivers; Nursing.

Objetivou-se identificar o perfil socioeconômico, sanitário e educacional de pais, avaliar a percepção dos responsáveis sobre desenvolvimento da criança, no primeiro ano de vida. Estudo descritivo, realizado de novembro/2008 a fevereiro/2009. Participaram 50 crianças de 3 a 12 meses de idade e 50 pais/responsáveis, em Fortaleza-CE-Brasil. Utilizou-se o Harris Infant Neuromotor Test — HINT, em português. As idades das crianças variaram de três a onze meses e vinte dias. 26 (52%) do sexo masculino. A idade das mães foi em média de 24,5 anos. Dos cuidadores, 23 (46%) em união estável, 16 (32%) com ensino médio incompleto e 27 (54%) famílias com renda entre R\$ 464,72 (US\$202,05) e R\$ 929,44 (US\$404,10). A participação dos cuidadores sobre o desenvolvimento da criança foi acurado em suas próprias percepções, quando comparado à interpretação dos escores do HINT avaliados por enfermeiras treinadas em desenvolvimento infantil.

DESCRITORES: Desenvolvimento Infantil; Cuidadores; Enfermagem.

El objetivo fue identificar el perfil socioeconómico, de salud y educacional de los padres de niños, evaluar la noción de los responsables sobre el desarrollo del niño en el primer año de vida. Estudio descriptivo, llevado a cabo de noviembre/2008 a febrero/2009. Participaron 50 niños y 50 padres/responsables, en Fortaleza-CE-Brasil. Se ha utilizado el Harris Infant Neuromotor Test — HINT en portugués con niños de 3 a 12 meses de edad. La edad de los niños varió de tres meses a once meses y veinte días. La mayoría, 26 (52%), sexo masculino. La edad materna presentó media de 24,5 años. De los cuidadores, 23 (46%) unión estable, 16 (32%) enseñanza media incompleta y 27 (54%) familias con una renta entre R\$ 464.72 (US\$202,05) y R\$ 929,44 (US\$404,10). La participación de los cuidadores sobre el desarrollo del niño, fue preciso en sus propias percepciones, cuando comparado con la interpretaciones de los escores del HINT evaluados por los enfermeras capacitadas en desarrollo infantil.

DESCRIPTORES: Desarrollo Infantil; Cuidadores; Enfermería.

* Study developed through the Scientific Initiation/PIBIC Project: Profile of caregivers of children between 3 and 12 months of age: emphasis on child development, 2009/CNPq and Validation of Harris Infant Neuromotor Test — HINT in the Brazilian version/CNPq.

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INTRODUCTION

Longitudinal evaluation of children's growth and development consists of observing and monitoring the attainment of specific age-appropriate milestones (e.g., cognitive, speech/language, motor) in order to determine if children are on target with their overall development. Since 1984, the strategy of the Ministry of Health in Brazil has been to prioritize basic health interventions with demonstrated effectiveness: the promotion of breastfeeding; immunization, prevention and control of diarrheal diseases and acute respiratory infections; as well as the child's overall growth and development⁽¹⁾.

Early childhood represents a critical period for learning and skill development, which suggests the importance of studying various aspects of child development⁽²⁾, including motor development. The parents' environment and socio-economic levels are important influences on the attainment of their children's social and cognitive skills and overall health. A previous study demonstrated differences in mental and motor skills among infants in the first year of life associated with families' various socio-economics levels⁽³⁾.

The participation of parents, guardians, and other caregivers in their children's care is important to the development of young children. A significant difference between adulthood and childhood, biologically and chronologically, is that childhood is portrayed as living together with adults as dependent for care and support in many aspects of life⁽⁴⁾. The birth of a child brings expectations about roles to be played by all family members, including any main caregiver, and the realization of the need for communication among parents and children⁽⁵⁾.

In both at-risk infants and apparently healthy infants (without known risk factors), early identification of delays in motor and/or cognitive development is critically important because such early detection can then lead to referral for early intervention

services⁽⁶⁾, aimed at supporting both the infant and the infant's family. The Harris Infant Neuromotor Test (HINT) is a screening tool that aims to identify delays in neuromotor development and/or cognitive/behavioral development in healthy or high-risk infants between 2.5 and 12.5 months of age⁽⁷⁾. The HINT is a non-invasive test that can be administered and scored in 20-30 minutes by pediatric physical or occupational therapists, nurses, physicians, or early childhood special education professionals⁽⁸⁻⁹⁾. It is unique among infant motor assessment tools in that it includes a section of questions that assess the caregiver's level of concern about the infant's movement and play⁽¹⁰⁾.

It is pertinent to contextualize the use of the HINT in Brazilian children, specifically in Ceará. The first author completed post-doctoral training through the University of Victoria in Canada (2007-2008), assisting in studies that assessed neuromotor development of children during the first year of life, under the supervision of Dr. Virginia Hayes⁽¹¹⁾. During this same time period, the fourth author conducted her doctoral thesis research, introducing the administration and use of the HINT to nurses, teachers and scholars at the Scientific Initiation at Federal University of Ceará/UFC⁽⁴⁾. As a result of carrying out these studies, we observed the importance of parents' involvement in child care and, consequently, in monitoring child development. The inter-relationships among parents/caregivers and nurses was made evident, as well as the importance of communication among nurses, other health professionals, and the parents or caregivers, and also parents' communication with their infants.

Consequently, we developed the following research questions: 1) What are the perceptions of parents/caregivers about the development of their children during the first year of life? 2) Are parents' perceptions of their infants' development related to their infants' final HINT scores? The objectives of this study were to identify the socioeconomic profile of parents and children in the first year of life; to analyze the perceptions of caregivers about their

infants' neuromotor development and; to relate their perceptions to final scores on the Harris Infant Neuromotor Test (HINT), Portuguese version.

MATERIALS AND METHODS

This was a descriptive, exploratory study, which was carried out in two public institutions in Fortaleza, Ceara, Brazil. One is a tertiary-level, federal maternity and the other is a health center that provides primary care. The population consisted of infants aged 3 to 12 months who were discharged from low-risk neonatal and/or rooming-in units, and same-aged infants treated at the health care center, along with their parents/caregivers. The sample consisted of 50 children and 50 caregivers, based on the following inclusion criteria: infants 3 to 12 months of age, healthy, without apparent risk for developmental delay, birth weight greater than or equal to 2500 grams, gestational age 37 weeks or more.

Data were collected from November 2008 to February 2009 during individual home visits. Two instruments were used: the Portuguese version of the Harris Infant Neuromotor Test (HINT)⁽¹¹⁾, and a questionnaire for collecting information about housing conditions, monthly income, family income (minimum wage — in Brazil it is a minimum salary that a company pays its workers), the number of rooms in the home, the number of people living in the home, sewage, and type of flooring material, as well as anthropometric data for the infant. We obtained some data from medical records of families and some from the participating children's parents or guardians.

The HINT consists of four parts. The **first** section provides information about the child's birth and neonatal period (chronological age, birth weight, sex, prenatal and post-natal risk factors) and information about the caregiver (age, educational level, occupation, race). The **second** part has five questions directed to the parents or primary caregiver about how their infant moves and plays and any concerns

they may have about their infant. The **third** portion is the actual infant assessment section, with 22 items observed and scored by the examiner. These items cover aspects such as motor behavior, locomotion, posture, and head circumference measurements. The HINT total score ranges from 0 to 76, with lower scores representing more mature (or more optimal) infant development. The **fourth** part indicates the action suggested by the examiner in accordance with the evaluation results and total HINT scores⁽⁷⁾. The HINT can be administered to children aged 2 months and 16 days to 12 months and 15 days. Age intervals are divided into ten age groupings, each with a one-month period.

The data were organized on a spreadsheet in the EXCEL program and analyzed by SPSS[®] (Statistical Package for the Social Sciences, Version 14) as frequencies, percentages, means and medians. The study was approved by the Committee for Ethics in Research of the institution where the study was developed (protocol number 56/08).

RESULTS

It is important to know parents' socio-demographic and education data and neonatal anthropometric data when clinically assessing infant development, because these variables can directly or indirectly affect children's health. In this study, we obtained these data from the first part of the HINT and from a specific questionnaire about housing conditions.

Table 1 — Neonatal Anthropometric Data for the Sample. Fortaleza, Ceara, Brazil, 2009

Variables	Mean	Median
Gestational age in weeks (n = 50)	39.02	39
Age at assessment in months and days (n = 50)	5 mo 14 days	5 mo 15 days
Weight in grams (n = 50)	3393.66	3462.50
Height in centimeters (n = 36)	49.94	50
Head Circumference in centimeters (n = 29)	34.31	34
Thoracic perimeter in centimeters (n = 26)	32	32

Table 2 — Demographic Profile for Mothers and Fathers. Fortaleza, Ceará, Brasil, 2009

Variable	Mothers (n = 50)		Fathers (n = 46)	
	n	%	n	%
Marital Status*				
Common Law	23	46.0	23	46.0
Married	17	34.0	17	34.0
Single	10	20.0	10	20.0
Age				
14-21	20	40.0	6	13.0
22-28	16	32.0	19	41.3
29-37	9	18.0	13	28.3
38-46	5	10	8	17.4
Race*				
Brown	24	48.0	29	58.0
Caucasian	18	36.0	11	22.0
Black	6	12.0	10	20.0
Yellow	1	2.0	-	-
Indigenous	1	2.0	-	-
Paid work				
Yes	16	32	35	76.1
No	34	68	11	23.9
Education				
Illiterate (no education)	1	2	-	-
Incomplete primary school	16	32	10	21.7
Completed primary school	10	20	12	26.1
Incomplete secondary school	7	14	6	13.0
Completed secondary school	16	32	17	37.0
Completed higher education	-	-	1	2.2

*n=50

Twenty-three mothers (46%) lived in common law relationships, 17 (34%) were married, and 10 (20%) were single. Maternal age ranged from 14 to 46 years of age, with a mean of 25.3 years; median of 24.5 years.

About two-thirds of the mothers (n = 34) had no paid work. Of the remainder, four were seamstresses, four vendors, four maids, one a hairdresser, one a marketer and one an artisan. Among the mothers responsible for the infants included in the study, four (8%) did not report any information about their infants' fathers. The fathers' ages ranged from 16 to 46 years, with a mean of 26.8 years and median of 27 years.

Fathers' professions included: caretakers (n = 5), cooks (n = 2), vendors (n = 4), lecturers (n = 3); two each were workmen, serigraphs, deliverymen, waiters, mechanics, or office assistant technicians; and one each was a driving school instructor, a dresser, a carpenter's assistant, a blacksmith and an operator of heavy machinery.

Table 3 — Socio-demographic Data of Families (n = 50 caregivers). Fortaleza, Ceará, Brazil, 2009

Variables (n=50)	Number	%
Income (minimum wage)*		
< 1	16	32.0
1 — 2	27	54.0
3 — 4	4	8.0
> 4	3	6.0
Number of rooms in home		
1 — 3	13	26.0
4 — 6	27	54.0
7 — 10	8	16.0
10 or more	2	4.0
Number of people living in the home		
3 — 5	32	64.0
6 — 9	16	32.0
10 -13	2	4.0
Sewage		
Yes	43	86.0
No	7	14.0
Type of Floor		
Tiling	28	56.0
Cement	15	30.0
Hard-pack	7	14.0

* The minimum wage was R\$ 464.72 (US \$202, 05) in the year that the research was conducted (2009).

Table 3 shows the socioeconomic status and health conditions of the children's families. For 54% of families, family income of caregivers was up to two minimum wages, and yet 32% lived on less than the minimum wage. Garbage collection was available to 96% of the households; that is, only two homes lacked the service. Most homes (86%) were provided with basic sanitation, but seven (14%) had no sewage system.

In Table 4, we compared the HINT total scores (as administered by research team assessors) and the infants' motor development, as reported by the parents (Item 3 of the HINT parent questionnaire).

Table 4- Distribution of Parents' and Professionals' Evaluation of Motor Development of Infants. Fortaleza, Ceará, Brazil, 2009

Assessment Total Scores						
Interpretation of HINT total scores	Minimum	Maximum	Mean	Median	N	%
by research team						
Advanced (> -1 SD)	4	31.5	16.36	16	25	50
Within normal limits (-1 SD to <+1 SD)	4	42	18.42	18	25	50
Parent questionnaire (item 3)						
Ahead of schedule (advanced)	-	-	-	-	30	60
Right on target (at age level)	-	-	-	-	16	32
Slightly delayed for age	-	-	-	-	4	8

DISCUSSION

The infant and family assessments ($n = 50$) were conducted by trained nursing professionals during home visits, thus allowing for direct observation of the infants, family environment, and quality of the interactions between infants and their caregivers. In addition, we observed positive interactions among assessors, parents/guardians, and the infants, probably because the natural home environment is a safe and comfortable research space for parents and children.

The infants' ages ranged from 3 months (exactly) to 11 months and 20 days (mean = 5.5 months). The average gestational age was 39.0 weeks. Twenty-seven (54%) babies were born by C-section and 23 (46%) by vaginal delivery. According to the Live Birth Information System (SINASC), a birth registry in Ceara Brazil, there were 134,026 babies (preterm, term and post-term) born in 2007, of whom 39.9% were born by C-section. Of the 125,262 term infants born that year 39.4% were delivered by C-section⁽¹²⁾.

The study infants weighed between 3501 and 4000 grams, had a mean height of 49.94 cm, a mean head circumference (HC) of 34.31 cm, and a mean thoracic perimeter (TP) between 30 and 34 cm. In the medical records and immunization cards of the infants, there was no peri-natal information about height for 14 children, about HC for 21 children and TP for 24 children. In this study, most of the mothers (46%) lived in common-law relationships and their average age was 24.5 years. Paternal data ($n = 46$) show that the average was 27.0 years, with greatest prevalence in the age group from 22 to 28 years (41.3%).

Most informants characterized both mothers and fathers as brown skinned, as would be expected among Brazilian people. For wider cross-cultural comparisons, we need studies of large and varied populations. However in Brazil, this type of research would be very challenging as there is such a complex racial mix.

The first stage of basic education in Brazil, pre-school or infant education, is offered in day care centers for children under 3 years of age and in pre-schools for children aged 4 to 6 years. The Fundamental Education program has a minimum duration of eight years for children between 7 and 14 years old⁽¹³⁾. Secondary school, the final stage of basic education, lasts at least three years and meets the general education of the student⁽¹⁴⁾. Most of the parents in this sample had attended secondary school (34%). The mothers either had incomplete primary school education (Fundamental Education) (32%) or had completed secondary school (32%). In Ceará, 70% of the female population is literate and about 80% have not completed Fundamental Education⁽¹⁵⁾.

This socioeconomic variable (caregiver education level) is important because the major source of comparison is the Canadian HINT normative data, a study of 412 full-term infants, 39.8% of whose mothers had much higher education and only 11.9% of whom had not completed high school. Although Ravenscroft and Harris concluded that maternal education did not

appear to be associated with infant motor development as assessed by the HINT⁽¹⁶⁾, maternal education may play a role in child development and health in Brazil where a lower standard of education is more prevalent, influencing families' quality of life.

The educational level of the mother has been shown to be associated with the socioeconomic condition of the family, and may be significantly related to maternal and child health, and therefore has important applications for the delivery of health care⁽⁴⁾. Another socioeconomic factor of importance for the participants in this study is that most mothers did not have paid work (68%), though 70% of the fathers had some kind of income-producing employment. Twenty-seven families (54%) earned between one and two minimum wages (i.e., from R\$ 464.72 to R\$ 929.44 or from US \$265.55 to US \$531.10). According to economic indicators, 75% of the population of the State of Ceará is economically active, i.e., a population that is actively involved in the workforce, yet 60% of household heads earn less than a monthly minimum wage⁽¹⁴⁾. In this study, even without paid work, most families had incomes between one and two minimum wages. It has been noted that family income is an important indicator of appropriate child health, emphasizing the close relationship between families' socioeconomic situations and children's health⁽¹⁷⁾.

We found that 28% of the infants were born weighing between 3501 and 4000 grams; 14% between 3001 grams and 3500 grams, and 12% weighing between 2500 and 3000 grams. Despite the low income among the children's families studied, most of the babies had good birth weight.

Waste collection was made periodically by the public service in 96% of the households and there was basic sanitation in 86% of the houses. Twenty-seven homes were of four to six rooms, and the majority (56%) had ceramic tiled floors. There were three to five people in 32 (64%) households. Housing and sanitation conditions are important indicators of well-being and health of the residents and indirectly reflect

quality of life of the families in this study. In a study carried out in Rio Grande do Sul/ Brazil with 634 children and their mothers, it was identified that in those homes that have seven or more people, there was a high probability of a negative environment for child health⁽¹⁸⁾.

Despite the relationship between maternal, paternal, socioeconomic profile and child development status, the infants in this study showed good overall health.

The child's environment, interaction with people, and social and developmental support and encouragement are factors that may shape aspects of motor behavior⁽⁴⁾. Positive home environments facilitate physiological development, enabling exploration and interaction with the overall environment. But the pace of development and learning possibilities of children become limited in unfavorable environments⁽³⁾.

The HINT parental perception questions were presented orally to the caregivers, of whom 82% were mothers and 18% grandmothers. The vast majority of primary caregivers (92%) rated their infant's movement and play as ahead of schedule or right on target on item 3 of the HINT parent questionnaire. Classifying the HINT total scores within each age group, 50% of infants were within normal limits based on the Canadian normative data and 50% were advanced, i.e., <1 SD from the mean. Thirty caregivers (60%) classified their infants as being above the expected development according to age 16 (32%) in accordance with age, and only four (8%) of the caregivers rated their infant as "slightly delayed" as compared to other children of the same age. In terms of HINT score summaries, assessed infants may be advanced in their development, within normal limits, suspect, or atypical. It was observed that in this sample, most of the children had advanced or typical neuromotor development.

When caregivers were asked how their infants felt as they carried, held, or played with the infant, the predominant response was "soft and cuddly" (44%),

followed by two choices: both “soft and cuddly” and “solid and firm” (36%), and “solid and firm” alone (20%). The options “somewhat floppy or loose”, “very floppy or loose”, “somewhat stiff” and “very stiff” were not selected by the caregivers interviewed, thus supporting the finding that motor development was likely normal.

When asked about how their babies moved and played, ninety percent of caregivers chose the answer “Just great, I am very pleased” and only 10% (5) chose “Okay, I feel pretty good about her/him.” The options “Okay, but I’m a little worried” and “Not too well; I am quite worried” were not selected by any informants, which demonstrates the satisfaction of caregivers about the general movement and play of their children.

When questioned about how their infant moved and played as compared to other infants, 30 (60%) of the caregivers answered “Ahead of schedule (or advanced),” while 16 (32%) rated their infants’ development as “Right on target (at age level)”, and only 4 (8%) chose “Slightly delayed or slightly behind”. The option, “very delayed” was not selected by any of our 50 informants.

The last two “parental perception” questions on the HINT are open-ended, and caregivers can identify any issues of their own or of family members, neighbors, or health professionals in relation to their infants’ movements, play, and/or interactions with the environment and people. The majority (90%, n=45) of the caregivers reported no concerns in relation to their children’s development, but five did report some special concerns (such as an infant’s not being able to sit, late onset of walking, or negative behaviors associated with parental fear of the infant falling).

These data indirectly demonstrate the commitment of caregivers (mothers and grandmothers) to their children. They were consistently concerned with accident prevention, provision of basic needs, supporting healthy development, and so on. In an earlier study of 65 families in Fortaleza in 2004-2005, the authors found a statistically significant association

between the variables accident type and age of the child ($p = 0.000$). Of 101 accidents, mostly falls, the most affected age group was the 2-year-old group (40.6%), and then 1-year-olds (28.71%). Caregivers must be alert to any risk of accident, providing their children with a secure environment⁽¹⁹⁾.

Only four caregivers reported concerns expressed by other people or professionals. Two mothers reported that the infants’ fathers shared their concerns. Other accounts given: *His grandmother says he should be walking* and *His father and his grandmother complained because he still cannot sit down*.

Reviewing the HINT total scores from the research team’s assessments, 50% (25) of the infants themselves were found to be “advanced”. Ninety-two percent (n = 46) of the caregivers had similar ratings of their infants’ abilities to those of the assessors, a result that is considered favorable in that caregivers realistically evaluated their infants and were knowledgeable enough about growth and development to make this assessment.

Motor milestones that guide the evaluation of development and are used by experts in child development indicate that at three months of age, infants are typically able to roll from side-lying to supine. At four months, babies can maintain their heads in an upright position when in supported sitting and, at five months, they can roll from supine to prone position and sit alone momentarily. At six months of age, infants can move from one place to another by rolling, and can crawl and stand with support by seven months. At eight months, babies can sit alone independently and can walk with help and hold their own bottle by nine months of age. From 10 to 12 months, infants learn to stand and walk and can climb up on sofas and chairs⁽²⁰⁾. Even with such common milestones delineated for the various age groups, infants are affected by different cultural and environmental influences. These act as stimuli that limit or accelerate their development⁽²¹⁾.

Informants in this study reported that many other people participated in raising their infants, especially grandmothers. Data show that the support of grandmothers is particularly important for family. In general, mothers prefer the maternal grandmother and other maternal relatives to help care for their children, with their opinions generally respected by other family members⁽²²⁾. Thus, family members, especially grandmothers, are seen as partners in child care, sharing knowledge and practices to promote learning and strengthen the family in the process⁽²³⁾.

CONCLUSION

This study provided descriptive data about using the HINT as a tool for quantitative evaluation of Brazilian infants of modest socioeconomic means and living conditions, knowledge that is not yet well developed in pediatric nursing in Brazil. In this Brazilian sample, we have demonstrated that, although the families are low-income, the children are meeting or exceeding their developmental motor milestones as established in the literature.

Our results show that parents/caregivers (mothers and grandmothers) generally have the same opinions about their infants' development, such as in their expressed perceptions that they are satisfied with how their children move and play and their categorization of development compared to that of children of the same age as "Just great, I am very pleased" and "Ahead of schedule". The HINT items that assess the perceptions of parents/caregivers about development are indispensable for family-centered assessment of children.

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